Dorman B. Eaton, Columbia University receives 100,000 dollars to found a professorship of municipal science and administration, and Harvard University 100,000 dollars to endow a chair in the science of government. Mr. Louis H. Severance, of New York City, has given 60,000 dollars to Oberlin College for a chemical laboratory. The provision made for the college by Mrs. C. E. Haskell amounts to 77,000 dollars. St. Lawrence University has recently received a gift of 24,000 dollars from a friend of that institution. A half million dollars will be distributed by Dr. D. K. Pearsons, of Chicago, among fourteen colleges throughout the United States. Most of his donations will be made on condition that the colleges raise a certain amount, generally 50,000 dollars, or an amount equal to the gift, within a given time. Dr. Pearsons has already given 2,500,000 dollars to the cause of education.

SCIENTIFIC SERIALS.

Transactions of the American Mathematical Society, January.—At the February meeting of the Society last year, the President announced that the Council had reported that it was "desirable and feasible, and in all respects for the best interests of mathematical science in this country, that the Society should undertake the periodical publication of *Transactions*, beginning with January 1, 1900." The well-printed and altogether admirable first part is now before us, and we heartily wish good speed to the venture, "the success of which is already well assured." The size of the page is approximately 11 × 8 inches, and so is intermediate between the *Bulletin* and *American Journal of Mathematics* pages.—Conics and cubics connected with a plane cubic by certain co-variant relations, by H. S. White, is a paper which was read, with a slightly different title, at the August (1899) meeting. By employing the irrationality that occurs in Hesse's canonical form of the cubic, the writer is able to identify Hilbert's two systems of irrational co-variant conics, and to exhibit certain other relations, and thence to give explicitly co-variant equations of definition for the two cubics which have the same Hessian, and for those which have the same Cayleyan, as a given fundamental cubic. The results are attained by the aid of a canonical form of the cubic containing Hesse's irrationality. The conics discussed are Hilbert's co-variant conics (*cf.* letter addressed to M. Hermite, Liouville, vol. iv. 1888). The invariantive proofs of some of the foregoing results are given in the next paper, Formentheoretische entwickelung der in Herrn White's Abhandlung über curven dritter ordnung enthaltenen Sätze, by Paul Gordan.—Sur la définition générale des fonctions analytique, d'après Cauchy, by E. Goursat, has its object thus indicated.—J'ai reconnu depuis longtemps que la démonstration du théorème de Cauchy, que j'ai donné en 1883, ne suffisait pas la continuité de la dérivée. Pour répondre au désir qui m'a été exprimé par M. le Professeur W. F. Osgood, je vais indiquer ici rapidement comment on peut faire cette extension.—On a class of particular solutions of the problem of four bodies, by F. R. Moulton, treats the case of three bodies finite, moving in *circles* according to one or the other of the solutions of Lagrange, while the fourth is infinitesimal.—Definition of the Abelian, the two hypo-Abelian, and related linear groups as quotient groups of the groups of isomorphisms of certain elementary groups, by Dr. L. E. Dickson, aims at giving a natural definition of these groups based upon Jordan's "important, but artificial, conception of *exposants d'échange*." It is written in the author's usual thorough style.—H. Maschke gives a half-page note on the unilateral surface of Mœbius.—On regular singular points of linear differential equations of the second order whose coefficients are not necessarily analytic, by M. Bôcher. The writer remarks that since the time of Cauchy it has been considered of interest to establish the existence of solutions of differential equations whose coefficients are functions of a real variable x, and to do this without requiring these coefficients to be analytic functions of x, but merely continuous functions. It is a natural extension of this point of view to wish to investigate the nature of singular points of such equations, *i.e.* of points where the coefficients become discontinuous. It is M. Bôcher's object to carry through such an investigation in a special case, viz. that of

$$\frac{d^2y}{dx^2} + p\frac{dy}{dx} + qy = 0,$$

where the independent variable (x) is real, and p, q are functions of x, which are not required to be analytic.—The elliptic σ-functions considered as a special case of the hyperelliptic σ-functions, by O. Bolza. This paper has a two-fold object. In the first place it gives a sketch of the theory of the "elliptic" in the light of the theory of the "hyperelliptic" functions; and secondly, it serves as an introduction for a future paper in which an analogous presentation is given of the hyperelliptic σ-functions.—Dr. G. A. Miller writes on the groups which are the direct products of two sub-groups, and E. H. Moore discusses certain crinkly curves (reff. are made to papers by Peano, *Math. Ann.* vol. xxxvi.; Cesàro, *Bulletin des Sciences Math.*, vol. xxi. 1897; Hilbert, *Math. Ann.* vol. xxxviii.). There are several diagrams.—Dr. L. E. Dickson gives a new definition of the general Abelian linear group.—If the high character of the present number is maintained, it is safe to prophesy that the *Transactions* are come to stay.

Bollettino della Società Sismologica Italiana, vol. v. 1899–1900, No. 6.—On seismic registrations of long period, by E. Oddone (see p. 477).—The earthquake of Ventotine on March 27, 1899, and the tromometric records obtained at the Collegio Bianchi, in Naples, and at Reggio di Calabria, by P. G. Costanzo.—Earthquake of Balikesri, in the north-west part of Asia Minor, on September 14, 1896, by G. Agamennone.—Notices of earthquakes recorded in Italy (July 30–October 11, 1898), by A. Cancani, the most important being the earthquakes of Janina on July 31, Calabria-Sicily on August 6 and 12, and Umbria-Marches on August 25 and September 11, and distant earthquakes on September 1, 13 and 22.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, February 22.—"The Ionisation of Dilute Solutions at the Freezing-point." By W. C. D. Whetham, M.A., Fellow of Trinity College, Cambridge.

This paper contains a description of the electrical part of a joint research, by Mr. E. H. Griffiths and the author, on the freezing-points and electrical conductivities of very dilute solutions of the following substances:—Sulphuric acid, potassium chloride, barium chloride, copper sulphate, potassium permanganate, potassium ferricyanide and potassium bichromate. In order to eliminate the effect of dissolved glass, the water used as solvent was distilled in a platinum still and collected in platinum vessels; a known weight was then placed in a platinum cell, and weighed quantities of stock solution added, in successively increasing amounts. The concentration of the solutions thus prepared was calculated in terms of the number, m, of gram-equivalents of solute dissolved in one thousand grams of solution. In order to control the temperature, the platinum cell was surrounded by a coil of tubing through which evaporated ether vapour could be passed. The whole was surrounded by a brass case fixed in the middle of a large tank filled with broken ice. The walls of the platinum vessel formed one electrode, and a platinum cage suspended within it the other. Inside this cage revolved a platinum tube which contained a thermometer, and also served as the shaft of a screw. This screw kept the contents of the cell at a uniform temperature, and mixed the stock solutions with the liquid previously within the cell. The electrical resistances were measured by the method of alternating currents, the connections of the Wheatstone's bridge with a dry cell and with a D'Arsonval galvanometer being reversed simultaneously by means of a revolving commutator driven by a hand wheel and cord. This arrangement is more convenient and more sensitive than the usual telephone apparatus. The conductivity thus found was corrected for the conductivity of the solvent, and the result, k, divided by m, gave the equivalent conductivity of the solution. Curves were drawn between $\sqrt[3]{m}$ and k/m, and the maximum value of these taken to indicate complete ionisation. The ionisation, α, of the solutions was then calculated by dividing the maximum k/m into its actual value, and new curves were drawn between $\sqrt[3]{m}$ and α. The general form of these curves resembles that of the corresponding ones obtained by Kohlrausch and other observers at 18°, but the slant of the lines is different both from Kohlrausch's observations, and also from new observations made with the present apparatus at 18°. The abnormal type of curve found at 18° for acids and alkalies is shown to appear at 0° in the case of sulphuric acid, the ionisation reaching a maximum as the dilution is increased, and then suddenly becoming much less. Reasons are given for doubting the usual explanation of this effect, which refers it to interaction with the residual impurities of the solvent, the phenomena being different to those observed in the case of permanganate, a salt showing a somewhat similar drop in the curve, for which the usual explanation is satisfactory. Potassium bichromate gives a curve consisting of two well-marked parts—perhaps owing to a change in the nature of the ions at different concentrations. Mr. Griffiths is engaged in measuring the depression of the freezing-point of corresponding solutions, and, when his results are published, a comparison of the two sets of values will be made.

March 1.—"Mathematical Contributions to the Theory of Evolution. VIII. On the Correlation of Characters not Quantitatively Measurable." From the Department of Applied Mathematics, University College, London. Presented by Karl Pearson, F.R.S.

In August last I presented to the Royal Society a memoir on the inheritance of coat-colour in thoroughbred horses, and of eye-colour in man. This memoir, which was read in November of last year, presented the novel feature of determining correlation between characters which were not capable *à priori* of being quantitatively measured. The theoretical part of that memoir was somewhat brief, but I showed by illustrations that the method could be extended to deal with problems like the effectiveness of vaccination and of the antitoxin treatment in diphtheria. More recently, in studying the phenomena of reversion in Basset Hounds, Mr. Bramley-Moore indicated to me how my method, although correct in theory, differed sensibly in the numerical results with the processes of interpolating employed. I then proposed a new method, and the analytical discussion of its details was worked out in part by Mr. Bramley-Moore himself, by Mr. L. N. G. Filon, M.A., and by myself. Dr. Alice Lee also came to our assistance, and the result is the present joint paper. On the basis of the new methods, we have already worked out upwards of sixty coefficients of correlation, principally of heredity.

The theory of the present memoir depends upon a very simple feature of normal correlation. If $z\delta x_1\delta x_2 \; . \; . \; . \; . \; \delta x_n$ be the frequency of a complex of characters lying between x_1 and $x_1+\delta x_1$, x_2 and $x_2+\delta x_2 \; . \; . \; . \; .$, x_n and $x_n+\delta x_n$, where x_p is the deviation of the *p*th character from its mean, then

$$\frac{dz}{dr_{pq}}=\frac{d^2z}{dx_p dx_q}$$

where r_{pq} is the correlation of the *p*th and *q*th organs.

This simple differential relation enables us to expand z for any number of characters in powers of the correlation coefficients (necessarily less than unity) by Maclaurin's theorem. But since we may replace a differential with regard to a coefficient of correlation by a double differential with regard to the corresponding organs, the coefficients of correlation may be put zero *before* instead of after the differentiation. In other words, we obtain a symbolic operator which, applied to a normal surface of frequency for n-uncorrelated organs, converts it into a correlated surface of frequency with $\frac{1}{2}n(n-1)$ coefficients of correlation of arbitrary values. This operator gives us by aid of certain symbolic equations the expansion of the n-fold integral

$$\int_{h_1}^{\infty}\int_{h_2}^{\infty}\int_{h_3}^{\infty} \ldots\ldots \int_{h_n}^{\infty} z\,dx_1 dx_2 dx_3 \ldots\ldots dx_n$$

in terms of the $\frac{1}{2}n(n-1)$ coefficients of correlation, and a series of new functions which we term the v-functions. These satisfy the difference equation:

$$v_n=xv_{n-1}-(n-1)v_{n-2}$$

and the differential equation

$$\frac{dv_n}{dx}=nv_{n-1}.$$

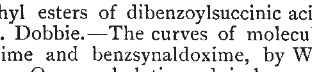
The calculation of these functions is shown to be easy, and their properties are investigated. In this manner the volume of a frequency surface of the *n*th order cut off by *n* planes parallel to the *n* co-ordinate planes is shown to be capable of calculation, and its value is determined in the numerical illustrations given for example of 1, 2, 3 up to 6-fold correlation. It may be noted that by putting $h_1=h_2=h_3= \ldots \ldots =h_n=0$, we have really obtained a result which enables us to find the "area" of a "spherical triangle" in n-fold hyperspace in terms of a series ascending by powers and products of the cosines of the angles between its faces.

The application of these results to the correlation of characters not quantitatively measurable, arises from the fact that the n-fold integral above given, and which we have shown how to evaluate, measures the total frequency beyond certain boundaries. We can observe, for example, whether horses' coats are bay and darker (or chestnut and lighter), whether eyes are grey and lighter (or, dark grey and darker). Thus by forming mass frequencies instead of frequency distributions for small changes of character, we can find equations to determine the correlation. The probable error of such correlation, the convergency of the series, and other points are investigated.

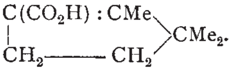
A number of illustrations of the new method are given from heredity in horses, dogs and man, and it is shown how normality of frequency must even for such a character as stature only be looked upon as a first approximation.

An investigation is also made into the influence of superior stock in producing superior offspring. It is shown, for example, that if an individual who possesses a degree of character only found in one in twenty be considered "exceptional," then eighteen times as many exceptional men will be born of non-exceptional parents as of exceptional parents; but, on the other hand, exceptional parents produce exceptional offspring at a rate ten times as great as non-exceptional parents, the greater gross product of the latter being due to their much greater numbers. In other words, distinguished parents are more likely to have distinguished offspring than undistinguished—ten times as likely—and yet only one distinguished man in nineteen will be born of distinguished parents. The importance of such conceptions for both natural and artificial breeding can hardly be over-estimated.

Chemical Society, March 1.—Prof. Thorpe, President, in the chair.—The following papers were read:—On pilocarpine and the alkaloids of jaborandi leaves, by H. A. D. Jowett. The jaborine of commerce is shown to be a mixture of isopilocarpine, pilocarpidine and a trace of pilocarpine with colouring matter; no evidence has been obtained of the existence of the alkaloid previously described as jaborine.—Isomeric partially racemic salts containing quinquevalent nitrogen. Hydrindamine bromocamphorsulphonates, chlorocamphorsulphonates and *cis*-π-camphanates, by F. S. Kipping. The author explains the formation of two isomeric salts of externally compensated hydrindamine with bromocamphorsulphonic, chlorocamphorsulphonic or *cis*-π-camphanic acid as due to partial racemism.—New syntheses of indene, by F. S. Kipping and H. Hall. Hydrindamine hydrochloride decomposes almost quantitatively into indene and ammonium chloride when heated.—Potassium nitritohydroximidosulphates and the non-existence of dihydroxylamine derivatives, by E. Divers and T. Haga. Raschig's dihydroxylamine derivatives are merely crystalline compounds of potassium nitrite with the 2/3 and 5/6 normal potassium hydroximidosulphates. — Identification and constitution of Fremy's sulphazotised salts of potassium, by E. Divers and T. Haga.—Some acids obtained from α-dibromocamphor, by A. Lapworth and E. M. Chapman. Camphonic acid, $C_{10}H_{16}O_3$, obtained by hydrolysing α-monobromocampholid, is a ketonic acid yielding an oxime, a semicarbazone and phenylhydrazones; it may be converted into tribromocamphonolactone, which fact indicates that bromocamphorenic acid has the constitution



—Spectrographic studies in tautomerism. The absorption curves of the ethyl esters of dibenzoylsuccinic acid, by W. N. Hartley and J. J. Dobbie.—The curves of molecular vibrations of benzantialdoxime and benzsynaldoxime, by W. N. Hartley and J. J. Dobbie.—On campholytic and isolauronolic acids, by J. Walker and W. Cormack. As a result of further work, the authors consider that campholytic and isolauronolic acids are stereoisomeric, their structure being best represented by the formula



—The configuration of the camphoric acids, by J. Walker and J. K. Wood.—The constitution of camphoric acid, by J. Walker. The author considers the Perkin-Bouveault formula for camphoric acid to be the most satisfactory hitherto proposed.

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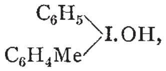
[1] Cited by so many as an example of "normality."

—On the presence of invertase in plants of the Gramineæ (I.), by J. O'Sullivan.—Iodonium compounds of the type IR′R″R‴ and the configuration of the iodine atom, by F. S. Kipping and H. Peters. The authors have prepared phenylparatolyliodonium hydroxide



$$\begin{matrix} C_6H_5 \\ C_6H_4Me \end{matrix} \Big\rangle I.OH,$$

and, since they could not resolve it into enantiomorphous components, they conclude provisionally that the three iodine valencies are arranged in one plane.—Note on the decomposition of semicarbazones, by F. S. Kipping. On heating benzaldehyde semicarbazone it yields the azine

$$C_6H_5.CH : N.N : CH.C_6H_5 ;$$

the formation of azines from aromatic semicarbazones is a fairly general reaction.

Geological Society, February 16.—Annual General Meeting.—W. Whitaker, F.R.S., President, in the chair.—The reports of the Council and of the Library and Museum Committee having been adopted, the medals and other awards already announced (p. 279) were presented. The President then proceeded to read his Anniversary Address, in which he first gave obituary notices of several foreign members, foreign correspondents, and fellows deceased since the last annual meeting. He then referred to the great advance in geological science in his own time, an advance that consisted largely of the arising of new lines of work and not merely of progress in old ones: thus petrology was a new branch of the science. Palæontology had been affected by the growth of the theory of evolution. In physical geology, such subjects as metamorphism, mountain-structure, and erosion had entered into new phases. In stratigraphy the geological series had been extended downward below the Cambrian, and, at the other end of the scale, our knowledge of the Drift had greatly developed, largely owing probably to geological discoveries connected with the antiquity of man. He then treated of the advance in our knowledge of underground geology, especially in the south-east of England, a subject in which comparatively little was known forty-five years ago; and he described in some detail the underground extension and thickness of various formations, particularly of those below the Chalk, under the heads Upper Greensand, Gault, Lower Greensand, Wealden and Purbeck, Jurassic, Lias and Trias, and Older Rocks, referring to the amount of knowledge which we possess in the London Basin, and its southern border in the Wealden district, as compared with the Hampshire Basin.

February 26.—J. J. H. Teall, F.R.S., President, in the chair.—"The Bunter Pebble-Beds of the Midlands and the Source of their Materials," by Prof. T. G. Bonney, F.R.S. The author states the results of occasional work in the Bunter Conglomerate of Staffordshire. After a sketch of matter already published, he gives additional particulars of the lithology of the pebbles, more especially of the felstones and of some rather compact dark rocks. The mode of transport and source of the pebbles are next considered. The reasons, already published, for a fluviatile, as opposed to a marine, origin are briefly summarised.—"Further Evidence of the Skeleton of *Eurycarpus Oweni*," by Prof. H. G. Seeley, F.R.S. The original specimen from which this species was named was obtained from the Sneewberg (South Africa) in 1876, and after being doubtfully referred to *Dicynodon* was described and figured in 1889. From a sketch the author is able to give some account of the skull, including its dimensions. From other material he gives new facts with regard to the vertebral column, the ribs, the shoulder-girdle, the fore-limb, the hind-limb, and the armour, which was present upon the limbs and the fore part of the body. The locality from which the animal was obtained appears to be one of the chief localities for the Lycosaurian types of Theriodontia, and to be on the horizon of the *Dicynodon*-beds. The recovery of the missing half of the Murray slab, with the evidence of the skull and pelvis which it would give, is to be desired in completion of our knowledge of this fossil animal.

Royal Microscopical Society, February 21.—Mr. Wm. Carruthers, F.R.S., the President, in the chair.—Mr. E. M. Nelson, in presenting a "'Jones' most improved combined microscope and apparatus," said the Society had not hitherto possessed an example of this instrument in its collection. The exact date of the instrument was a little uncertain, but he believed it to be about the last improvement in the non-achromatic microscope. The first published description of this microscope with a figure is to be found in Adams' "Essays on the Microscope," 1798.—Dr. J. W. Measures exhibited the photomicrographic and projection apparatus made by Carl Zeiss, of Jena. The apparatus was very complete, sufficing both for photo-micrography and for projection. The camera was fitted with a bellows divided into two parts, and though carried upon a stand separate from that which carried the microscope and illuminating apparatus no inconvenience had been found to arise from vibration. An arc light was used supplied by a continuous current of 65 volts and 30 amperes. The condenser, water-chamber, iris diaphragm, and other parts required for illumination were fitted upon saddles sliding upon a Λ-shaped rail in front of the lamp, so that when once they had been accurately centred they could be moved along the rail to any required position without getting out of the centre. The first part of the exhibition illustrated the use of the arrangements for projecting the images of opaque objects upon the screen. This was followed by the exhibition of microscopic slides, comprising insects, plant sections, marine polyps, and preparation of animal tissues chiefly by means of the Zeiss microplanar objectives. The last portion of the exhibition consisted of lantern-slides of plants, animals and landscapes, and some fine photo-micrographs of diatoms, lent for the occasion by Dr. Spitta. The apparatus is constructed so as to render the transition from *micro* to *macro* projection, and the reverse, rapid and easy, the rearrangement of parts being effected in from one to three minutes.

Linnean Society, March 1.—Dr. A. Günther, F.R.S., President, in the chair.—Mr. W. Saville Kent exhibited lantern-slides of several British flowering plants to show the remarkable advances which have been recently made in colour photography.—Mr. C. B. Clarke, F.R.S., read a paper on botanic nomenclature. He showed that the new rule adopted at Berlin—not to disturb names that had fifty years' user on the ground of priority alone—resulted in a practical uniformity with the system of naming adopted by Mr. Bentham and Sir J. D. Hooker. The Old World, he said, had thus reached a fair general agreement in nomenclature. The American botanists follow a new system which aims at finality on a so-called "non-shifting basis" in which the genus or species, as the case may be, is established on a type-specimen. Mr. Clarke's paper was devoted mainly to showing by selected instances that this system did not ensure finality; that the errors in determining what should be ranked as the type are enough to discredit the system; and the author commented on the disputed question whether a plant should be given the oldest specific name bestowed upon it, or the oldest specific name it bears in the genus in which it is now placed.—Mr. F. Chapman read a paper on some foraminifera of Tithonian age from the limestone of Nesseldorf.

Entomological Society, March 7.—Mr. G. H. Verrall, President, in the chair. Mr. H. Rowland-Brown was elected into the Council and as joint-Secretary in the place of Mr. J. J. Walker, R.N., who had resigned.—Mr. C. G. Barrett exhibited a series of varieties of *Spilosoma dorsalis* from South Africa, showing variation in some degree parallel with that of *S. lubricipeda* in Great Britain.—G. W. Kirkaldy exhibited several Rhynchota of economic interest, among them *Aegaleus bechuana*, Kirk., from Africa, which attacks coffee, and *Parlatoria victrix*, Ckll., from Phœnix, Arizona, found on date palms. The last-named Coccid was originally introduced from Egypt, and all attempts at eradication had hitherto failed. He also showed a series of thirteen colour-varieties of the oriental Scutellerine *Cantao ocellatus* (Thunb.), and examples of *Distantidea vedda* from Ceylon, in which the rostrum was very long, extending as far as to the apex of the abdomen.—Papers were communicated by Mr. W. L. Distant on "Undescribed genera and species belonging to the Rhynchotal family *Pentatomidae*," and by Mr. G. J. Arrow "On Pleurostict Lamellicorns from Grenada and St. Vincent (West Indies)." Mr. C. J. Gahan read a paper on "Stridulating organs in Coleoptera," in which he remarked that one of the best accounts of them was to be found in "The Descent of Man," but since that work was written several additional instances of their occurrence had been made known, showing that these organs were less uniform in structure and even more wonderfully diversified in position than Darwin considered them to be; while their discovery in the larvæ of certain forms would lead to some modification of the view that they have originated in connection with sex and primarily serve the purpose of attracting the sexes to one another.

Mathematical Society, March 8.—Prof. Elliott, F.R.S., Vice-President, in the chair.—The chairman announced that in accordance with a resolution passed at the Council meeting, the meetings of the Society would in future be held at 5.30 p.m. instead of at 8 p.m. as heretofore. The days of meeting will remain unaltered.—Prof. Elliott then dwelt upon the losses to mathematics which had resulted from the recent decease of Prof. E. Beltrami (Hon. Foreign Member), and of Mr. J. J. Walker, F.R.S. The latter gentleman was almost an original member of the Society, had served on the Council some twenty years, had been a most regular attendant at its meetings, and had contributed about twenty papers to its *Proceedings*. He had served as Vice-President four years, and President two years. Votes of condolence were unanimously passed in silence, and the senior secretary was directed to communicate to the relatives of the deceased the sympathy of the Society.—Prof. Lamb, F.R.S., read a paper, "Problems relating to the impact of waves on a spherical obstacle in an elastic medium."—Mr. W. F. Sheppard (Prof. Lamb, Vice-President, in the chair), spoke on the use of auxiliary curves in statistics, with tables for the curve of error.—Major Macmahon, F.R.S., Prof. Lamb and Mr. R. Hargreaves, discussed points which arose out of the communication.—A supplementary note on the theory of automorphic functions, by Prof. A. C. Dixon, was taken as read.

Cambridge.

Philosophical Society, March 5.—Mr. J. Larmor, President, in the chair.—Considerations regarding the Zeemann effect, by J. Larmor.—On the simplest algebraic minimal curves and the derived real minimal surfaces, by H. W. Richmond. The discovery of real algebraic minimal surfaces of the lowest degrees forms a part of the first of the two classical memoirs on the subject of minimal surfaces contributed by Sophus Lie to *Math. Annalen* xiv. and xv. When Lie's work is examined in the light of the fuller knowledge we now possess concerning space-curves of orders three or four, it appears that it is possible in most cases to write down the equations of the curves and surfaces found by him in a fairly simple form; but that one of the surfaces that he quotes is non-existent.—On Diophantine inequalities, by G. B. Mathews. This is a continuation of a recent paper of Major Macmahon's (*Camb. Trans.* vol. xviii).—Experiments on impact, by J. H. Vincent. When inflated india-rubber balls are allowed to fall on a stone floor the coefficient of restitution, e, is found to be a linear function of the velocity just before impact. This law holds also for a steel ball impinging on a block of india-rubber; but it does not hold for a steel ball impinging on the plane surfaces of blocks of paraffin wax, lead, brass and cast-iron. In these cases the curve obtained by plotting e against v the velocity of approach is convex towards the origin of co-ordinates and all the four curves are very similar; the value of e rises rapidly as v decreases. The permanent deformation produced by the impact was studied in these cases and was found to obey remarkably simple laws.—On the distance between the striæ and on other phenomena connected with the discharge of electricity, by R. S. Willows. The teaching of mechanics by experiment, by Prof. Ewing. Prof. Ewing pointed out how by a course of suitable experiments students could not only be rendered familiar with the general principles of mechanics but could at the same time learn how to apply these principles to practical questions, and how to detect and allow for the causes which produce aberrations from what may be called the theoretical result. He exhibited in illustration of his remarks a number of self-contained pieces of apparatus for experiments in statics, dynamics and elasticity.

Manchester.

Literary and Philosophical Society, March 6.—Prof. Horace Lamb, F.R.S., President, in the chair.—Dr. F. H. Bowman brought to the notice of the members the results of a series of experiments recently made in regard to the preservation of milk or cream by aeration. He explained that sterilised air is aspirated through the milk or cream in suitable vessels; and, after aeration for about twenty minutes in the sterilised air at ordinary temperature, it is found that the milk or cream so treated will keep sweet for from eight to ten days, though absolutely unchanged in composition in any way; the same milk or cream unaerated will become sour in two or three days. This discovery renders it possible for milk or cream to be kept or distributed in a perfectly pure and natural condition without the use of any preservatives or antiseptics.—On the production of nitric acid from air by means of the electric flame, by A. McDougall and F. Howles. The experiments were carried out with the view of obtaining the best conditions under which the oxidation of the nitrogen took place. The effect of varying the current in the flame was fully entered into, and the results clearly showed that for a maximum oxidation to take place the temperature of the flame must be as low as is consistent with steady working. The mode of obtaining the electric flames in parallel was described, and particulars were given relating to the drop in volts observed at the electrodes when the discharge is running. Various pieces of the apparatus used in the experiments were exhibited, photographs of the larger parts being thrown upon the lantern screen.

Edinburgh.

Mathematical Society, March 9.—Mr. R. F. Muirhead, President, in the chair.—The following papers were read:—A note on change of co-ordinate axes, by Prof. Steggall.—The conditions for multiple roots of the equation in λ $(a-\lambda, b-\lambda, \ldots\ldots)=0$, by Chas. Tweedie.—The analytical representation of a potential function by means of cylindrical and spherical harmonics, with applications to Green's problem, by John Dougall.

Dublin.

Royal Irish Academy, February 26.—Mr. John Ribton Garstin, F.S.A., Vice-President, in the chair.—Prof. D. J. Cunningham, F.R.S., read, for Prof. W. H. Thompson, a paper by the latter on degenerations resulting from cortical lesions of the temporal lobe.

Paris.

Academy of Sciences, March 12.—M. Maurice Levy in the chair.—Notice on the works of M. Eugène Beltrami.—On the sexual apparatus and double fertilisation in tulips, by M. L. Guignard. The author has extended his researches on the double fertilisation in the genus *Lilium*. Similar phenomena were observed to take place in *Lilium candidum* to those previously studied in *L. Martagon* and *L. pyrenaicum*, although the work was more difficult in the case of the cultivated species. In *Endymion*, however, there are differences in the female sexual apparatus, since the two polar nuclei, the union of which produces the secondary nucleus of the embryonic sac, approach and touch each other long before the penetration of the pollen tube into the ovule. But although flattened at the surface of contact, they do not fuse, their contours remaining quite distinct.—On survey work carried out by Russian engineers by the photographic method, by M. Laussedat. An account of the survey operations for the Transcaucasian railway. The photographic method is very expeditious, and costs only about one-third of the usual survey.—On a new reaction between certain aromatic aldehydes and the sodium derivative of borneol, by M. A. Haller. The sodium derivatives of three borneols, ordinary dextrorotatory and lævorotatory borneol and lævorotatory isoborneol treated with benzaldehyde in petroleum solution all gave the same benzylidene-camphor. Derivatives are also described in which methylsalicylic aldehyde and the corresponding para-compound are substituted for the benzaldehyde.—On an application of the method of successive approximations, by M. A. Davidoglou.

On the integration of linear equations when the discriminant is not zero, by M. J. Le Roux.—On the extension of the properties of a reduced function to the fractions of interpolation of Cauchy, by M. H. Padé.—The determination of standard points in the spectrum, by M. Maurice Hamy. The author combats the view put forward recently by MM. Perot and Fabry, that the ray $\lambda 508$ of cadmium may vary slightly in wave-length with the form of vacuum tube employed. The cadmium tube without electrodes has shown no sign of variation in the constitution of the rays emitted by it even after working for fifty hours.—Theory of propulsive helices, by M. Rateau. On gas motors, by M. L. Marchis. An analysis and criticism of the usual treatment of the cycle in gas engines. The usual assumptions lead to the absurd conclusion that the explosion produces no increase of the pressure.—On the experimental study of the Hertz exciter, by M. R. Swyngedauw. According to the theory of Poincaré and Bjerknes, the Hertz exciter emits a deadened vibration, for which the intervals between consecutive zeros of intensity are equal; the authors' views lead to the contrary result, that the intervals between two consecutive zeros should be unequal. The experiments here described show that the minima are not equidistant, and hence confirm the latter theory.—On the capacity of symmetrical conductors submitted to polyphase tensions, by M. Ch. Eug. Guye.—On the minimum volume of fluids, by M. Daniel Berthelot. A discussion of the limiting value of the co-volume.—Action of hydrogen peroxide upon baryta, by M. de Forcrand. A thermo-chemical study of the formation of barium peroxide in aqueous solution. The precipitate formed by mixing dilute solutions of baryta and hydrogen peroxide is regarded as $Ba.[O(OH)]_2$, which on further treatment with baryta gives $Ba[O.O]_2Ba$.—Reply to the remarks of M. D. Tommasi on the electrolysis of distilled water, by M. Th. Tommasina. A question of priority.—On the electrolysis of potassium chloride, by H. André Brochet. As the amount of free alkali present in the solution increases, the formation of hypochlorite diminishes.—Solubility of benzophenone, by M. E. Derrien. Determination of the solubility of benzophenone in twenty-four solvents. The measurements were not carried out at any fixed temperature (9°·6 to 17°·6 C.), and only one figure is given for each solvent.—Dichlordimethylamido-benzoylbenzoic acid, by M. Émile Severin.—The acetals of the phenols, by M. R. Fosse. The method employed is to heat the sodium derivative of the phenol, or a mixture of the phenol, with potash, with ethylidene dichloride in sealed tubes at 120° C. The preparation and properties of the acetals $CH_3.CH(O.C_6H_5)_2$ and $CH_3.CH.(OC_{10}H_7)_2$ are described.—Remarks on the transformation of organic material taking place during germination, by M. G. André. A series of proximate analyses of the Spanish haricot during different stages of germination.—The stores of carbohydrates in the seeds of lucerne, by MM. Em. Bourquelot and H. Hérissey.—Localisation of myrosin and gum in the *Moringa*, by M. F. Jadin.—On the origin and connections of the Arthropods with the class of Onychophores, by M. E. L. Bouvier.—Anatomical study of the male generative organs of the Coleoptera with compound testicles, by M. L. Bordas.—On some new bacteria in coal, by M. B. Renault. In addition to the bacilli and micrococci already described, a new species has been found, named *B. colletus*, and another, badly preserved, resembling the *Streptothrix chromogenes* of Gasperini.—On the regional types of metalliferous layers, by M. L. de Launay.—Synthesis of the vowels, by M. Marage. Two causes have been indicated by M. Marey as being concerned with the formation of vowels, the vibration of the air, and the transport of air in the supra-laryngeal cavities. According to the experiments of the author only the first of these is indispensable.—A new method of stereometry, allowing the stereoscopic determination of the three rectangular coordinates of any point whatever of a radiographic object, by MM. T. Marie and H. Ribaut.—Anodic influence on nervous conductibility in man, by M. S. Leduc.—Contribution to the study of the relations between the chemical constitution and the physiological action of the alkyl derivatives of the alka loids, by M. W. Rosenstein.

DIARY OF SOCIETIES.

THURSDAY, March 22.

Royal Society, at 4.30.—The Croonian Lecture: On Immunity, with Special Reference to Cell Life: Prof. Paul Ehrlich (of Frankfort-on-Main).

Royal Institution, at 3.—Equatorial East Africa and Mount Kenya: H. J. Mackinder.

Institution of Electrical Engineers, at 8.—Storage Battery Problems: E. J. Wade.

Institution of Mechanical Engineers, at 8.—Adjourned Discussion on Improvements in the Longworth Power-Hammer, and Portable Pneumatic Tools.—*Paper to be read:* Observations on an Improved Glass Revealer, for Studying Condensation in Steam-Engine Cylinders and rendering the Effects Visible: Bryan Donkin.

FRIDAY, March 23.

Royal Institution, at 9.—Some Modern Explosives: Sir Andrew Noble.

Physical Society, at 5.—An Electromagnetic Experiment: Prof. S. P. Thompson, F.R.S.—(1) Some Experiments illustrating Syntony; (2) An Electrical Micrometer: P. E. Shaw.

Institution of Civil Engineers, at 8.—The Development of the Modern Locomotive Engine: J. W. Cross.

SATURDAY, March 24.

Royal Institution, at 3.—Polarised Light: Lord Rayleigh.

MONDAY, March 26.

Society of Arts, at 8.—The Photography of Colour: E. Sanger Shepherd.

Institute of Actuaries, at 5.30.—The Methods of Analysing and Presenting the Mortality, Sickness, and Secession Experience of Friendly Societies, with Examples drawn from the Experience of the Manchester Unity of Oddfellows: Alfred W. Watson.

TUESDAY, March 27.

Royal Institution, at 3.—Structure and Classification of Fishes: Prof. E. Ray Lankester, F.R.S.

Royal Geographical Society, at 4.—Methods adopted in Surveying the Cordilleras of the Andes: Prof. Bertrand.

Anthropological Institute, at 8.30.—Native Life and Customs in Sarawak: Lantern Demonstration by Prof. A. C. Haddon, F.R.S.—Discussion by C. Hose, Resident of Baram, Sarawak; Dr. W. H. R. Rivers, and others.

Institution of Civil Engineers, at 8.—*Papers to be discussed:* The Great Central Railway Extension—Northern Division: F. W. Bidder; and The Great Central Railway Extension—Southern Division: F. Douglas Fox.

WEDNESDAY, March 28.

Society of Arts, at 8.—Leather for Bookbinding: Douglas Cockerell.

THURSDAY, March 29.

Royal Society, at 4.30.—*Probable Papers:* On the Retinal Currents of the Frog's Eye, excited by Light and excited Electrically: Dr. A. D. Waller, F.R.S.—Observations on the Electromotive Phenomena of Non-medullated Nerve: Miss Sowton.—Variation: Prof. J. C. Ewart, F.R.S.—Mathematical Contributions to the Theory of Evolution: On the Inheritance of Characters not capable of Exact Quantitative Measurement: Prof. K. Pearson, F.R.S.

Royal Institution, at 3.—Mountain Exploration in the Andes: E. A. Fitzgerald.

Chemical Society, at 3.—Annual General Meeting.——At 8.30.—Bunsen Memorial Lecture: Sir Henry Roscoe, F.R.S.

Society of Arts (Indian Section), at 4.30.—The Manufacture and Use of Indigo: Christopher Rawson.

FRIDAY, March 30.

Royal Institution, at 9.—Facts of Inheritance: Prof. J. A. Thomson.

SATURDAY, March 31.

Royal Institution, at 3.—Polarised Light: Lord Rayleigh.

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